UNCLASSIFIED [redacted]

ARMY AIR FORCES HISTORICAL STUDIES: N

INITIAL SELECTION OF CANDIDATES FOR

PILOT, BOMBARDIER AND NAVIGATOR TRAINING

[redacted]

PREPARED BY
ASSISTANT CHIEF OF AIR STAFF
INTELLIGENCE
HISTORICAL DIVISION

[redacted]

[redacted]

Army Air Forces Historical Studies: No. 2

Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training

Prepared by
Assistant Chief of Air Staff, Intelligence
Historical Division
November, 1943

C4-5426, AF

[redacted]

UNCLASSIFIED [redacted]

FOREWORD

It is the desire of the President, the Secretary of War, and the Commanding General, Army Air Forces, that a solid record of the experiences of the AAF be compiled. This is one of a series of studies prepared as a "first narrative" in the projected over-all history of the Army Air Forces.

The decision to make the information contained herein available for staff and operational use without delay has prevented recourse to some primary sources. Readers familiar with this subject matter are invited to contribute additional facts, interpretations, and constructive suggestions.

This study will be handled in strict compliance with AR 380-5.

THOMAS D. WHITE
Brigadier General, U. S. Army
Assistant Chief of Air Staff,
Intelligence

Constructive criticisms and additional facts and interpretations are requested. To that end perforated sheets, properly addressed, are included in the appendix.

[redacted]

C4-5426, AF

[redacted]

Henderson rebreathing apparatus, 3.
Holmgren yarns test (eye), 14.
Hunsaker, Dr. Jerome, 25.

Ishihara color vision tests, 14, 53.
Ives gratings (eye test), 2.

Jaeger eye test, 13, 53.
Jones, Col. Harris, 25.

Kelly Field, Tex., 2, 6, 31, 38.
Kraus, Col. Walter F., 25.

Lowry Field, Colo., 22.

McComas, H. C., 2.
Marine Corps, 11, 21.
Massachusetts Institute of Technology, 25; psychological tests, 1-2.
Maxfield, Francis, 2.
Maxwell Field, Ala., 24, 31, 38.
Medical Division, OCAC, 19, 24, 25.
Miles, W. R., 2.
Military Academy, 18, 25, 31, 33, 35.
Military Aeronautics, Division of, 3.
Military Personnel Division, OCAC, 21, 24, 25.

National Guard, 11, 18.
National Research Council, 25.
Naval Academy, 18.
Navy, 11, 21, 25.
Negro cadets, 11, 21, 52.
Non-college applicants, 46, 57.

Pan-American Airways, 22.
Personnel, Director of, 7, 10.
Personnel Procedures Section, TAG's office, 22, 23, 25.
Physical qualifications. See Qualifications, physical.
Princeton Ground School, 3.
Psychological Division, Office of the Air Surgeon, 7, 45.
Psychological Research Agency, Medical Division, 24.
Psychological Research Section, Maxwell Field, 24.
Psychological tests. See Tests, psychological.
Psychology, Division of, 3.

Qualifications for aviation cadet, 1, 4-5, 11-12, 52-59; educational, 7-8, 10, 20, 21, 22, 26; physical, Table IV, 13, disqualifying physical defects, in World War I, 5, in 1939, 16, 17(Table V); non-college applicants, 7-8, 21, 23, 35, 36, 46, 57. See also Age, Examinations, Negro cadets, and Tests.

Randolph Field, Tex., 18, 21.
Reserve Officers Training Corps, 11.
Rockwell Field, Calif., 2.

Schneider Index, 14.
School of Aviation Medicine. See Aviation Medicine, School of.
Selection of aviation cadets, 1-5, 7, 18-23. See also Examinations, Qualifications, and Tests.
Selection and Training of Aviation Cadets, committee of National Research Council, 25; chart, 56.
Smith, Col. Luther S., 25.
Snellen eye test, 13.
Statistical Division, Office of the Air Surgeon, 20.
Statistical Records Section, FTC, 7.

[redacted]

GLOSSARY

AAF	Army Air Forces
AAG	Air Adjutant General
AC/AS	Assistant Chief of Air Staff
AG	Adjutant General
AGO	Adjutant General's Office
AR	Army Regulations
ARMA	Adaptability Rating for Military Aeronautics
Cf.	Compare
Hq.	Headquarters
Ibid.	The same or the same place
MPD	Military Personnel Division
OCAC	Office Chief of Air Corps
RMA	Reserve Military Aviator
R&R	Routing and Record Sheet
SAM	School of Aviation Medicine
T&O	Training and Operations
TM	Technical Manual
WD	War Department

(10) Physical Examinations
(11) Policy
(12) Requirements for Appointment

Office of the Air Surgeon

Professional Division

Aviation Cadet Files

Research Division

"Test Ideas"

Records

Aviation Cadet Branch, Military Personnel Division

Office of the Air Surgeon
Professional Division
Research Division
Statistical Division

Conversations

Colonel G. L. Ball, Chief, Professional Division, Office of the Air Surgeon
Lieutenant Colonel Joseph Berkson, Chief, Statistical Division, Office of the Air Surgeon
Colonel C. Chenault, Executive Officer, Office of the Air Surgeon
Lieutenant Colonel W. S. Fitch, Chief, Aviation Cadet Branch
Major P. M. Fitts, Psychological Branch, Research Division, Office of the Air Surgeon
Lieutenant Colonel J. C. Flanagan, Chief, Psychological Branch, Research Division, Office of the Air Surgeon
Colonel L. E. Griffis, Chief, Research Division, Office of the Air Surgeon
Dr. W. O. Jenkins, Psychological Branch, Research Division, Office of the Air Surgeon
Colonel W. S. Jensen, Deputy Air Surgeon, Office of the Air Surgeon
Lieutenant Colonel J. M. Murray, Chief, Psychiatric Division, Office of the Air Surgeon
Major W. H. Redit, Historical Officer, Aviation Cadet Branch
Major C. F. Watson, Statistical Section, Aviation Cadet Branch
Miss Eleanor Gessford of the Aviation Cadet Branch, who has worked in the cadet field for over twenty-five years, was an invaluable source for information on every aspect of the program.

Books and Pamphlets

Armstrong, Harry G., Principles and Practice of Aviation Medicine. Williams & Wilkins Company, Baltimore, 1939.
Jensen, Walter S., Aviation Medicine. A lecture delivered at the Jewish Hospital, Philadelphia, Pennsylvania, April 29, 1943. Booklet.

[redacted]

BIBLIOGRAPHY

Official Documents

Congress:

United States Statutes at Large, Vols. 41, 54, 55.

War Department:

AGO Form No. 60, Application for Appointment as Aviation Cadet, August 11, 1942.

AGO Form No. 64, Physical Examination for Flying, May 20, 1941.

Annual Report of the Office of the Air Surgeon, 1942, 1943.

Annual Report of the Psychological Division, Office of the Air Surgeon, 1942.

Annual Report of the Surgeon General of the United States Army, 1940, 1941.

AR 40-105, May 29, 1923; c. 3, November 15, 1932; c. 4, February 12, 1936.

AR 40-110, February 21, 1939.

AR 615-160, c. 5, June 19, 1926.

AR 615-160, December 31, 1927.

AR 615-160, July 20, 1930.

Aviation Cadet Manual. Published by AGO, September 20, 1942.

Air Corps Qualifying Examination, Test AC-10-A. Prepared by Office, Chief of Air Corps, 1942.

Aviation Cadet Qualifying Examination, Test AC-10-G. Prepared by Headquarters, Army Air Forces, 1942.

Aviation Cadet Qualifying Examination, Test AC-10-H. Prepared by Headquarters, Army Air Forces, 1942.

Aviation Cadet Qualifying Examination, Test AC-12-I, "First Booklet," "Second Booklet." Prepared by Headquarters, Army Air Forces, 1943.

"The Aviation Cadet Qualifying Examination--A Report on the Purpose, Development and Validation of Test AC-10-A." Prepared by the Psychological Division, Office of the Air Surgeon, Headquarters, Army Air Forces, October 1942.

Aviation Cadet Training for the Army Air Forces. Prepared by the Recruiting Publicity Bureau, United States Army, June 3, 1943.

Circular No. 111, June 10, 1941.

Circular No. 3, January 5, 1942.

Daily Diary, Army Air Forces Training Command, 1943. In files of Headquarters, AAF Training Command, Ft. Worth, Texas.

Flying Cadets of the Army Air Corps. Published by AGO, 1939.

Flight Surgeon's Handbook. 2nd edition. Prepared by School of Aviation Medicine, April 30, 1943.

Flying Training Command Memorandum No. 50-25-1, February 24, 1943. Historical Report, Aviation Cadet Branch, Military Personnel Division, Week Ending September 11, 1943. In files of Historical Division, AC/AS, Intelligence.

[redacted]

physical examination procedures. During the intensive recruiting drive in the colleges during 1942, it had been found necessary to change from the completed Form 64 examination to a modified Form 63 examination because of an insufficiency of flight surgeons and of special equipment. Enlistments were stopped by executive order on December 5, 1942, and no further examination of civilians was done until recruiting was reopened in March 1943. During this interim the pre-aviation cadet college training program had been inaugurated. Because of this additional five months of training before the administration of the classification tests and of the final type "64" physical examination by the Classification Centers, it was decided to return to the final type "64" physical examination during the initial qualification of applicants so that eliminations for physical reasons after the extensive college training would be reduced to a minimum.

With the announcement that the administration of the classification tests for selecting pilots, bombardiers, and navigators was being transferred from the special Classification Centers to Army Air Forces Basic Training Centers, it became advisable to make a further change in physical examination procedure. Under the new procedure, utilizing a modified Form 63 examination for civilians, and a certificate for soldiers, all the medical facilities of the Army were made available for the examination of aviation cadet candidates, and a serious bottleneck in qualifying applicants was broken.[24]

From crude beginnings there has emerged a system for selecting aircrew candidates which, although far from perfect, rests upon a reasonably sound scientific basis and is producing satisfactory results. Prior to 1939 when only a few hundred men were needed to fill cadet quotas, qualifications were set at such a high level that a process of natural selection was operative. The men who survived the rigid mental and physical examinations were a superior group. With the inauguration in 1939 of the Air Corps expansion program requiring thousands of men, the old system of natural selection was no longer sound. In order to meet aircrew quotas the best possible use had to be made of the available manpower pool. Physical, mental, psychological, and psychiatric tests were designed with a view to measuring the degree of flying aptitude of the individual candidates and of eliminating those who were regarded as unfit for aircrew training.

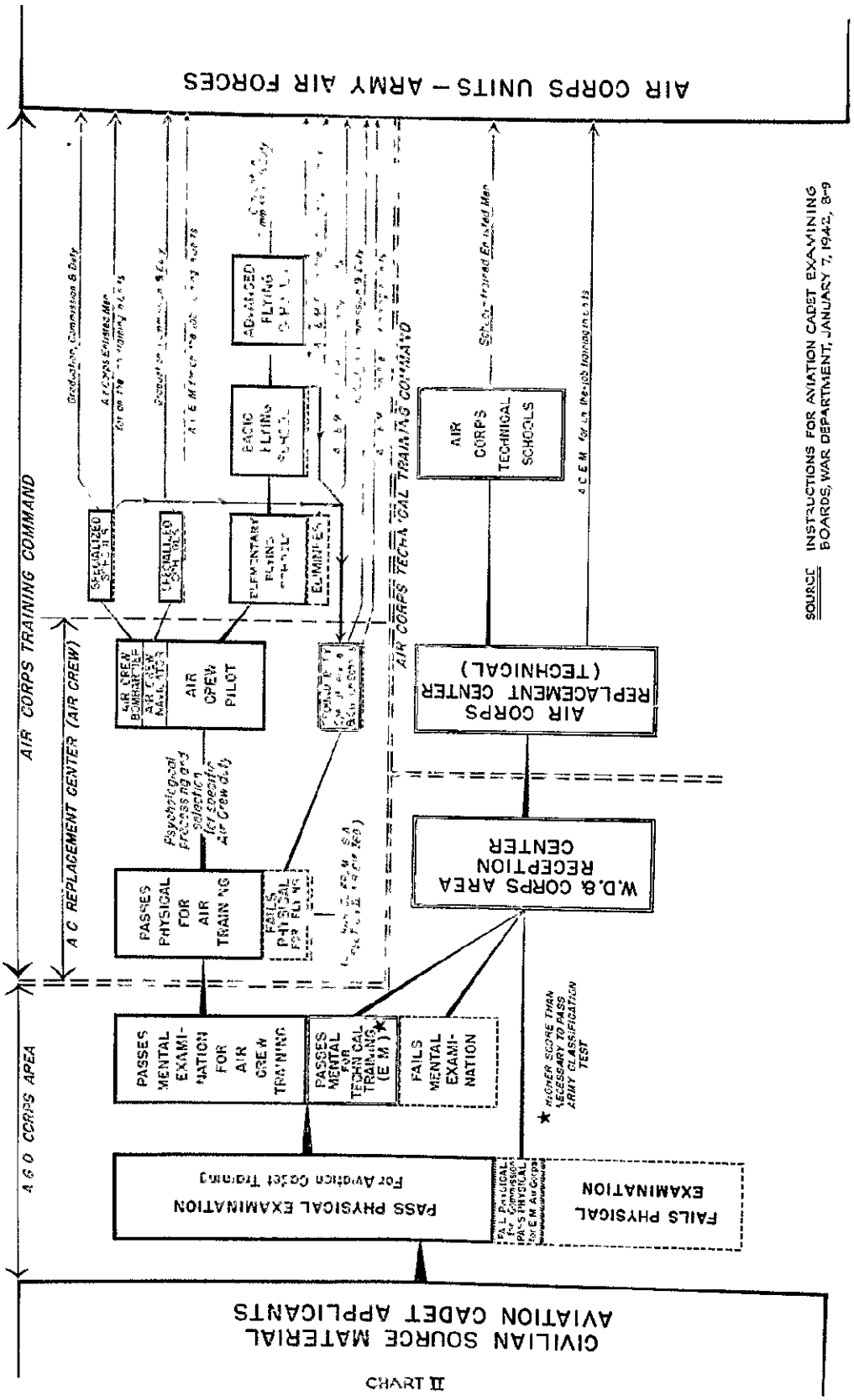
Selection practices today represent no radical departures from those employed in the twenties and thirties. They are rather the result of evolutionary processes. The Aviation Cadet Qualifying Examination now in use is simply an adaptation of earlier educational and psychological tests to the selection for aircrew training of candidates with flying aptitude. The Qualifying Examination is the work of no one man, nor of any one period. Its roots go back to the first World War, while recent changes are based on the latest research findings. Instead of attempting to measure purely verbal ability and mathematical aptitude, later forms of the Qualifying Examination emphasize the ability to interpret data, interest in aviation, and mechanical aptitude, since these qualities have been found to be more closely related to ability to fly than formal academic standards. The comprehensive physical examination in use today rests firmly upon foundations laid during the first World War. New apparatus has been devised and various modifications of the physical qualifications have been made from time to time so as to adapt the system more effectively to the selection of candidates physically qualified for flying, but they merely represent logical steps in a gradual evolutionary process.

The selection of candidates for aircrew training has been conditioned to a marked extent by the fundamental law of supply and demand. In the twenties and thirties when the number of applicants for training far exceeded Air Corps training quotas, both physical and educational qualifications were high and their application was strict. Following the inauguration of the expansion program in 1939 the Air Corps was faced with a very different situation. The number of applicants for aircrew training was insufficient to meet Air Corps training quotas. Procurement campaigns were instituted, and a relaxation in the interpretation of both physical and educational qualifications followed. Ultimately, the standards themselves were lowered, but in such a way as not to affect vitally the quality of aircrew personnel. While candidates are no

---

24. Historical Report, Aviation Cadet Branch, Week Ending Sept. 11, 1943, in files of Historical Division, AC/AS, Intelligence.

FLOW CHART
SELECTION AND TRAINING – AVIATION CADETS



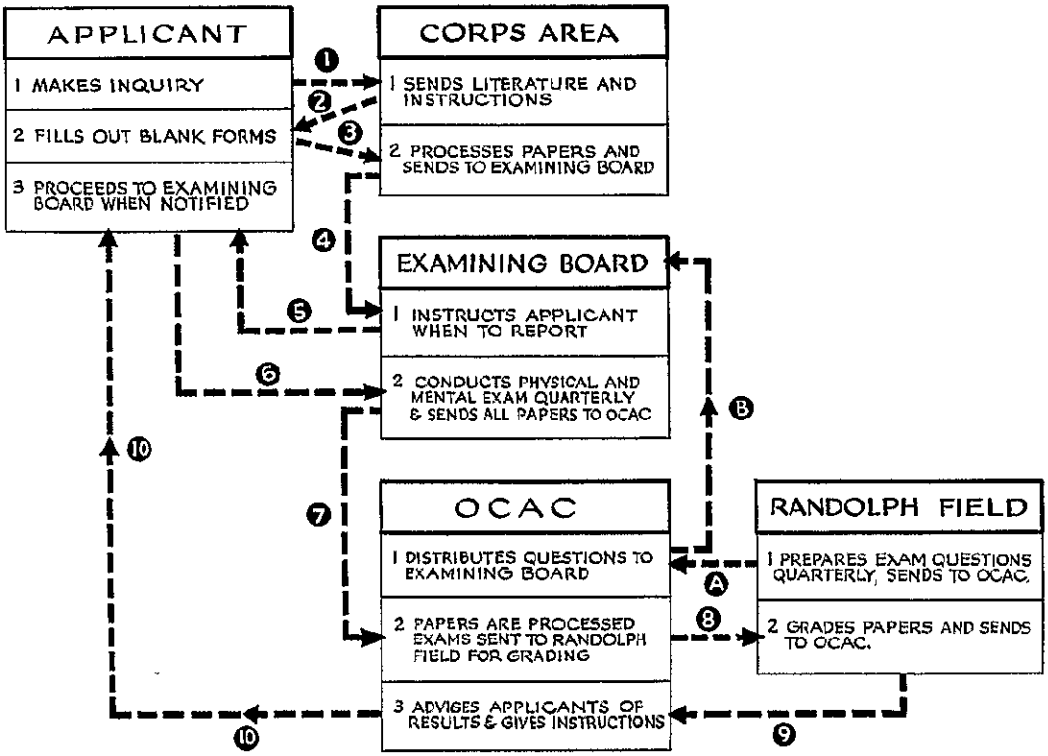
SOURCE: INSTRUCTIONS FOR AVIATION CADET EXAMINING BOARDS, WAR DEPARTMENT, JANUARY 7, 1942, 8-9

CHART II

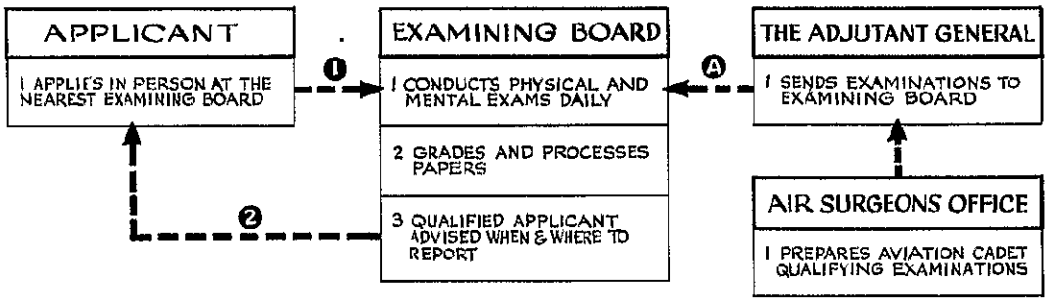
C 4-5426, AF

PROCESSING OF CADETS 1941-1942

A. PROCEDURE IN JANUARY 1941 — BEFORE DECENTRALIZATION



B. PROCEDURE IN JANUARY 1942 — AFTER DECENTRALIZATION



SOURCES. MEMORANDUM FOR GENERAL H A DARGUE FROM MAJOR B M GILES, A C, EXECUTIVE INSPECTION DIVISION JANUARY 8, 1941, IN AAG 352 12, EXAMINATIONS: INSTRUCTIONS FOR AVIATION CADET EXAMINING BOARDS, WAR DEPARTMENT, JANUARY 7, 1942

C4-5426, AF

CHART 1

[redacted]

Chapter V

OTHER SIGNIFICANT CHANGES IN INITIAL SELECTION PROCEDURES, 1941-1943

While the introduction of the Aviation Cadet Qualifying Examination was the most striking development in respect to the initial selection of aviation cadets in the period following American entry into the war, several other changes occurred which should be noted. In June 1941, as the entry of the United States into the armed conflict approached, there was added to the original requirement that the candidate be an American citizen, the stipulation that he must have been an American citizen for a period of at least ten years prior to the date of his application.[1] Waiver of this regulation was authorized where circumstances in the individual case warranted it.[2]

On December 13, 15, and 17, 1941, with Pearl Harbor still fresh in the minds of the American people, The Adjutant General sent radiograms to all the Service Commands directing that they open aircrew training to married men provided their dependents had sufficient means of support.[3] A short time later this restriction was removed and qualified married men were accepted for aircrew training on the same basis as unmarried men.[4] The Adjutant General also directed that final action on all qualifying examinations be taken by the Aviation Cadet Examining Boards, and applications were no longer to be sent to the headquarters office in Washington, except in the case of qualified Negro candidates and other special cases.[5] On January 5, 1942, the age limit for aviation cadets was lowered from twenty to eighteen years, thereby opening to the Air Corps an important new source of manpower.[6] Because of the acute shortage of medical examiners, Examining Boards were instructed to give the mental examination before the physical examination, thus reducing somewhat the flow of candidates through the flight surgeon's office.[7]

Physical standards were kept high in spite of much pressure to reduce them. The argument advanced by the Medical Division was that only men who would be physically fit for later combat duty should be trained. A limited teaching staff and training facilities, combined with the great cost of training aircrew members, were powerful arguments for the training of only the physically perfect. A few minor changes, such as the number of teeth and eliminations on the basis of old histories of diseases which had not been present for a number of years, were made,[8] but it was not until July 30, 1943, that any substantial relaxation was effected. At that time the physical requirements for flying were modified as follows:

---

1. WD Circular No. 111, June 10, 1941, Sec. V.
2. Instructions for Aviation Cadet Examining Boards. Requirements for Appointment as Aviation Cadet, Jan. 7, 1942; Aviation Cadet Examining Board, Grand Central Palace, New York City, to Aviation Cadet Branch, MPD, March 11, 1943, in files of Aviation Cadet Branch; Aviation Cadet Branch, MPD, to President, Aviation Cadet Examining Board, 166 Van Buren St., Chicago, Ill., June 2, 1943, in ibid.
3. Aviation Cadet Section, MPD, OCAC, to President, Aviation Cadet Examining Board, Maxwell Field, Ala., Jan. 2, 1942, in ibid.
4. Memo for Chief of Air Corps by General Cousins, AC/AS, A-1, Dec. 19, 1941, in AAG 211 E #2, Cadets.
5. Aviation Cadet Section, MPD, OCAC, to President, Aviation Cadet Examining Board, Maxwell Field, Ala., Jan. 2, 1942, in files of Aviation Cadet Branch.
6. WD Circular No. 3, Jan. 5, 1942, Sec. I.
7. AG to Commanding Generals, Corps Areas, May 2, 1942, in files of Aviation Cadet Branch.
8. Chief, Medical Division, OCAC, to Surgeon, Gulf Coast Training Center, Randolph Field, Texas, Dec. 31, 1941, in files of Professional Division, Office of the Air Surgeon; Instructions for Aviation Cadet Examining Boards, Jan. 7, 1942; Revised U. S. Army Air Force Aviation Cadet Program (effective April 4, 1942); Aviation Cadet Manual, Sept. 20, 1942.

Parts V, VI, and VII were tests of practical judgment, interest in aviation, and mechanical comprehension, respectively. The candidate was given two hours in which to work on them. Since tests of this type have already been described in detail in connection with the earlier forms of the qualifying examination, they will be given no further treatment here.[58]

Summary of Results of the Aviation Cadet Qualifying Examination

In summary, it may be said that each new form of the Aviation Cadet Qualifying Examination has been modified in the light of the latest research findings with a view to providing a more effective means of measuring flying aptitude and of adapting the examination more nearly to the changing conditions of aviation cadet recruitment. The increasing use of perceptual material, and the emphasis placed upon the candidate's ability to interpret data, his interest in aviation, and his mechanical aptitude are indicative of the changing concept of what qualities are essential for success in aircrew training. In time of war such factors as education and the social graces become secondary to the all-important question of whether the applicant can become a successful pilot, bombardier, or navigator. If he can, the Air Forces need him; if not, they cannot use him for aircrew training. The Aviation Cadet Qualifying Examination is helping hundreds of Aviation Cadet Examining Boards throughout the country to answer this question satisfactorily.

Table VIII shows the results of the Aviation Cadet Qualifying Examination during the last half of the fiscal year 1942 and during the fiscal year 1943. From January 15, 1942, to June 30, 1942, approximately 237,000 applicants took the Aviation Cadet Qualifying Examination and 51 per cent were successful in passing the test. During the fiscal year 1943 more than 431,000 applicants took the qualifying examination and 57 1/2 per cent of them passed the test.[59]

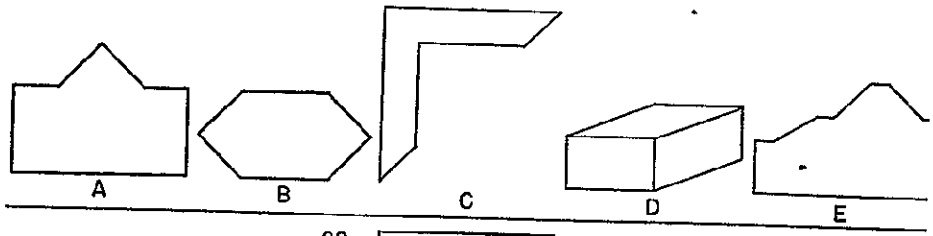
---

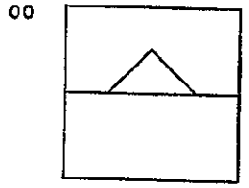
58. Ibid., "Second Booklet."
59. Records of Aviation Cadet Branch; Records of Psychological Branch, Research Division, Office of the Air Surgeon.

[redacted]

Directions: In each of the exercises that follow, you are to determine which one of five simple outlines is contained in a complex figure. Across the top of each page in this part there are five simple outlines *lettered* A, B, C, D, and E. *One* of these five outlines can be found in each of the *numbered* figures on the page. Look at each *numbered* figure as you come to it and decide which *one* of the five *lettered* outlines is contained in it. Then in the proper place on your answer sheet, blacken the space corresponding to the *letter* of the simple outline that is correct. The correct outline will always be found right side up in each *numbered* figure. Therefore, do not try to rotate the page in order to locate it. Remember, the correct outline in each *numbered* figure will be the *exact* size and shape of *one* of the *lettered* outlines at the top of the page.

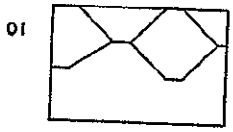
Below are the five simple outlines followed by two sample exercises.

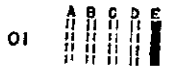




In sample 00, you will note that the simple outline lettered A is contained in the lower portion of the sample. Therefore the answer space below the letter A has been blackened.

In sample 01, decide which *one* of the five simple outlines above is contained in the numbered figure.





Outline E is contained in a portion of sample 01. Therefore space E has been blackened.[55]

55. Ibid., 9.

[redacted]

[redacted]

Part VI--Mechanical Comprehension. The length of this part was increased. Some additional types of items designed to measure practical mechanical abilities were introduced. More diagrams and drawings were included, and less emphasis was placed on the interpretation of written descriptions for mechanical devices.[50]

In summary, it may be said that the changes in the six parts of the examination were such that there was much less emphasis than formerly on vocabulary or purely verbal ability, and somewhat less emphasis upon mathematics. Conversely, there was much more emphasis upon the ability to interpret data, interest in aviation, and mechanical insight. All of the changes were based on actual research findings and repeated validation studies.

Analysis of Test AC-12-I

The introduction of Form AC-12-I of the Aviation Cadet Qualifying Examination in July 1943 represented a decided departure from the earlier forms. The changes were designed to adapt the examination to the changing conditions of aviation cadet recruitment. By the summer of 1943 the Air Forces had largely exhausted their reservoir of college trained men. It was evident that an increasingly large percentage of aircrew candidates would have to be obtained from non-college sources and from the group under twenty years of age. AC-12-I was specifically designed for testing these groups. It demanded less educational background than was required by earlier forms of the test. The increased use of perceptual material in this examination was believed to provide a more accurate measure of aptitude for aviation cadet training, especially for the younger applicants, than some of the more formal material in the earlier forms of the examination.[51] Aviation Cadet Examining Boards were requested to invite all applicants whose scores on recent forms of the examination had not been more than ten points below passing to try the revised test.[52]

The new examination consisted of two separate booklets. The "First Booklet," which was divided into four parts, contained several types of perception tests which were also speed tests. Research had indicated that one of the qualities essential for success as a pilot, bombardier, or navigator was quick, accurate perception, and these tests were designed to measure this aptitude. The "Second Booklet," which was divided into three parts, contained materials similar to those which had been found in the earlier forms of the Qualifying Examination, and it was designed to test the applicant's judgment, mechanical comprehension, and interest in aviation. These tests were not speed tests, but for administrative reasons a time limit of two hours was imposed.[53]

A brief description of the seven parts follows. Part I was an Electrical Maze test, in which the candidate was to determine at which one of five places a single battery should be connected to operate a meter. Forty-five items were furnished the candidate, and he was given fifteen minutes in which to solve as many of them as possible. The directions given the candidate along with a sample item are shown on following page.

Part II was a Gottschaldt Hidden Figures test, in which the candidate was to determine which one of five simple outlines was contained in a complex figure. Forty-five items were furnished the candidate, and he was given fifteen minutes in which to solve as many of them as possible. The directions given the candidate along with a sample item are shown on page 48.

---

50. Aviation Cadet Qualifying Examination, Test AC-10-G (1942), ibid., Test AC-10-H (1942)
51. Ibid., Test AC-12-I, "First Booklet," "Second Booklet" (1943)
52. Memo for Commanding General, Army Service Forces by Executive, Office of the Air Surgeon, July 16, 1943, in AAG 702.5, Misc. Psychological Exams; Hq., Third Service Command, Procurement Memorandum No. 98, July 23, 1943, Aviation Cadet Branch files.
53. Memo for Commanding General, Third Service Command by AG, July 26, 1943, in files of Aviation Cadet Branch.

[redacted]

[redacted]

6. Mechanical Comprehension: This part was highly useful in the selection of pilots. The degree to which it predicted pilot success is indicated in Figure 13. It selected pilots almost as well as the judgment part. The elimination rate for men who scored "E" was three times as great as for men who made a grade of "A". These results indicated that mechanical comprehension was one of the more important aptitudes required of the pilot. Scores on this part of the Qualifying Examination also correlated positively with success in navigation and in bombardiering.[48]

RELATION BETWEEN SCORE ON PART VI, MECHANICAL COMPREHENSION SECTION, TEST AC-10-A, AND ELIMINATION RATE IN PILOT TRAINING

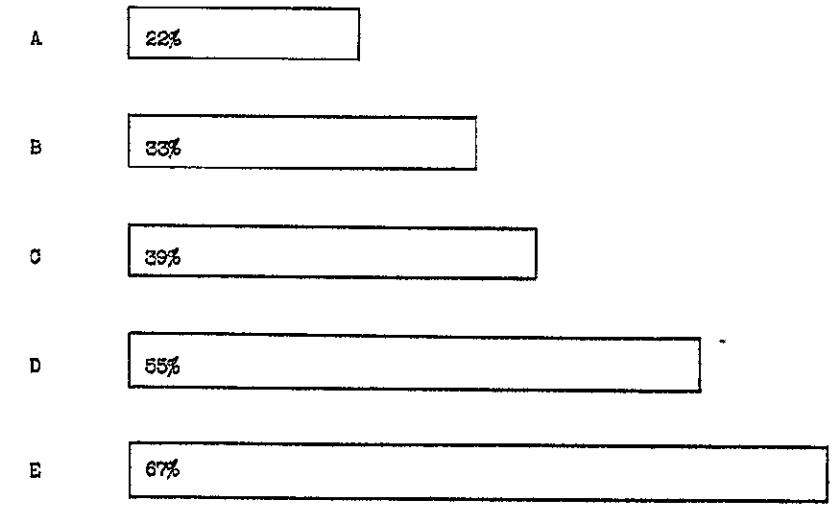


FIGURE 13

These data are based on 719 Pilots (Aviation Cadets and Aviation Students) of Class 42-G, who were tested for research purposes at Maxwell Field, Alabama. The tests were given in January, 1942 before flying training was begun, but the results were not used for classification.

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 32.

48. Ibid., 25-26.

[redacted]

[redacted]

4. Knowledge of Recent Developments: This part was designed to measure interest. It was found that scores on this part predicted success in pilot training with a fair degree of success. This relationship is shown in Figure 11. A more detailed analysis of the specific questions in this part showed that knowledge of recent developments in the field of aviation was much more important in the selection of aviation cadets than a knowledge of recent developments in related fields.

RELATION BETWEEN SCORE ON PART V, KNOWLEDGE OF RECENT DEVELOPMENTS, TEST AC-10-A, AND ELIMINATION RATE IN PILOT TRAINING

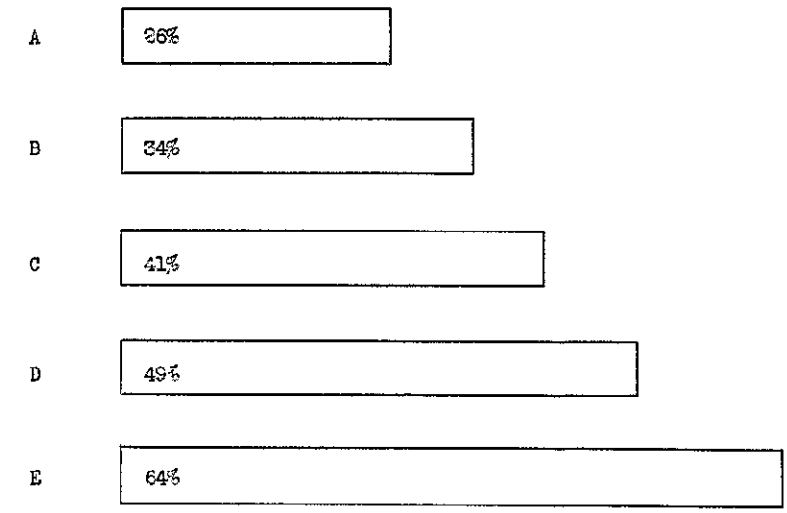


FIGURE 11

These data are based on 719 Pilots (Aviation Cadets and Aviation Students) of Class 42-G, who were tested for research purposes at Maxwell Field, Alabama. The tests were given in January, 1942 before flying training was begun, but the results were not used for classification.

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 30.

[redacted]

C4-5426, AF

[redacted]

2. Vocabulary: The vocabulary part was one of the more extensive sections of Test AC-10-A. Results showed that it was of special value only for the prediction of success in navigation school. The relation between the vocabulary score and navigation training is shown in Figure 9.

RELATION BETWEEN SCORE ON PART I, VOCABULARY SECTION, TEST AC-10-A, AND ELIMINATION RATE IN NAVIGATION TRAINING

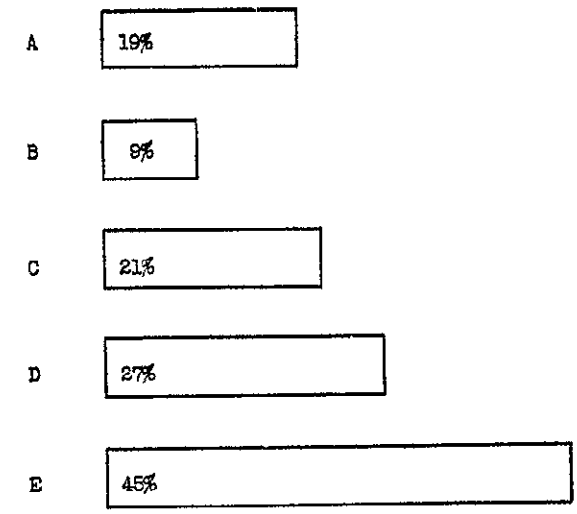


FIGURE 9

These data are based on 221 Navigators of Classes 42-6, 42-7, and 42-8, who were tested for research purposes at Maxwell Field, Alabama. The tests were given in January, 1942 before navigation training was begun, but the results were not used for classification.

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 28.

[redacted]

[redacted]

TABLE VII

COMPARISON OF THE ELIMINATION RATE FOR MEN PASSING TEST AC-10-A WITH ELIMINATION RATE FOR MEN FAILING THE TEST

	Score of 90 or Above (Passing)			Score of 89 or Below (Failing)		
Air-crew Specialty	Total Number	Number Eliminated	Percent Eliminated	Total Number	Number Eliminated	Percent Eliminated
Pilots-Cadets	443	167	37.7	102	59	57.8
Pilots-Students	87	28	32.2	87	48	55.2
Pilots-Total	530	195	36.8	189	107	56.6
Navigators-Cadets	200	36	18.0	21	11	52.4
Bombardiers-Cadets	156	14	9.0	35	4	11.4

These data are based on the complete training records of Class 42-G for pilots, and Classes 42-6, 42-7, and 42-8 for navigators and bombardiers. These men were tested at Maxwell Field, Alabama, during the First part of January, 1942. All cadets and students already had been selected and classified for air-crew training. Test results were used for research purposes only.

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 24.

In addition to the data included in Table VII, which are for men tested at Maxwell Field, data were assembled on 1,360 aviation cadets and 286 aviation students tested at Kelly Field. The elimination rates for Kelly Field aviation cadets who passed and failed the examination were 41.1 per cent and 60.4 per cent, respectively. The elimination rate for aviation students who passed the examination was 39.8 per cent, as compared with 56.3 per cent for students who failed the examination. The Kelly Field data were thus in close agreement with those obtained at Maxwell Field.[46]

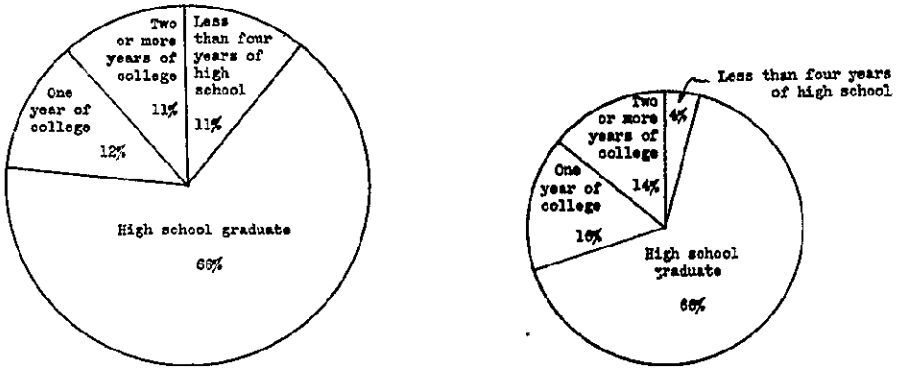
A consideration of these data leads to the conclusion that the first form of the Qualifying Examination was a very useful test for selecting applicants for aviation cadet training. The results of preliminary research testing indicated that men who scored 90 or above on this examination had a much greater chance of graduating from training than did the men who scored 89 or below. Since these results were obtained on aviation cadets, all of whom were college men, and on aviation students, all of whom had been carefully selected for pilot training, it is safe to conclude that if the test could have been validated on an unselected group of students, it would have been found to be an even better selection device than is indicated by the above findings.

Studies were made also of the elimination rate in comparison with scores on the six parts of the Qualifying Examination. In order to simplify this analysis, scores on each part of the test are recorded as "A", "B", "C", "D", or "E". These scores are defined as follows:

46. Ibid.

[redacted]

COMPARISON OF THE EDUCATION OF ALL APPLICANTS FOR AVIATION CADET TRAINING WITH THE EDUCATION OF MEN WHO PASS THE AVIATION CADET QUALIFYING EXAMINATION



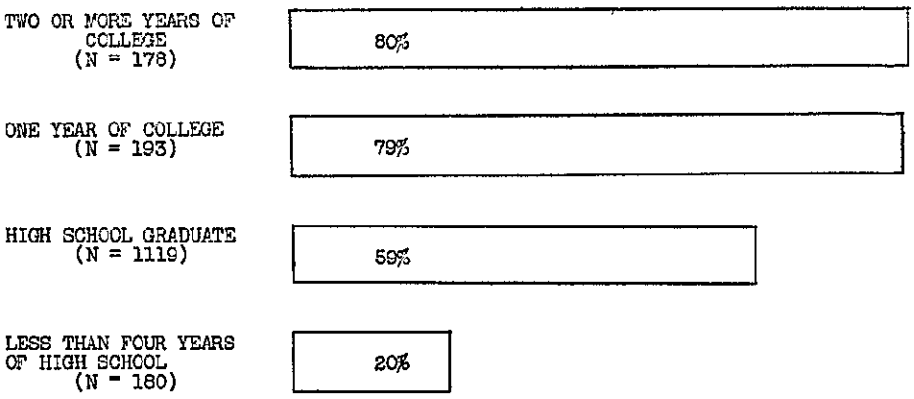


FIGURE 7

These data are based on all men who were given Test AC-10-A by the Philadelphia Aviation Cadet Examining Board from January 15, 1942 to March 1, 1942.

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 21.

Perhaps the most interesting thing about the report is that we secured 179 qualified applicants out of the high-school group and an additional 73 out of the one-year college group, or a total of 252 which we would not have secured if the qualifications for appointment were still held at the two-year college requirement.

It is also interesting to note that 15 out of 107 men with two years of college or more were disqualified. It is perhaps safe to assume that these 15 men would not have been satisfactory as officer material inasmuch as they could not pass a relatively easy screening test.[42]

The reaction of this examining board is typical of that of other boards and of officers concerned with aviation cadet selection.[43]

42. Report of the Aviation Cadet Examining Board, San Francisco, Calif., to the Commanding General, West Coast Training Center, March 25, 1942, in ibid., 20.
43. "Report on the Aviation Cadet Qualifying Examination," 23.

[redacted]

The Aviation Cadet Qualifying Examination [36] was also tried out in a number of colleges. In Figure 5 are shown the percentages of freshmen and sophomores who passed the test in four different colleges.[37] The marked difference that was found in the percentage passing in the four different colleges is striking. This is explained in terms of the nature of the schools. College A was a large, Class I institution, where entrance requirements were very high. Colleges B and C were typical state universities. College B had a large proportion of engineering students. College D had very low entrance requirements. The true figures representing the number of college freshmen or sophomores throughout the country who could qualify on the test would probably lie somewhere between the figures for Colleges B and C.

In Figure 6 is shown the distribution of scores made by a group of 1,000 men who were representative of those who applied for training during the first two months following release of the Aviation Cadet Qualifying Examination on January 15, 1942.[38] There is some evidence to indicate that the men who applied during these early months of war were better qualified and better educated than later applicants. A large number of these early applicants were college men. Since a smaller proportion of college men applied in later months, the percentage of applicants passing the examination decreased slightly.

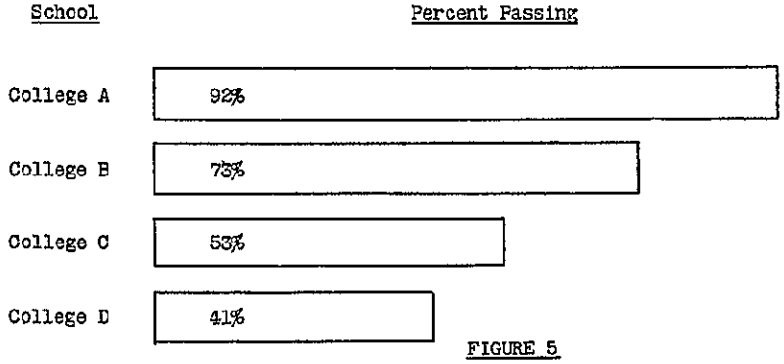


FIGURE 5

PERCENT OF FRESHMEN AND SOPHOMORES
IN FOUR DIFFERENT COLLEGES WHO PASSED TEST AC-10-A

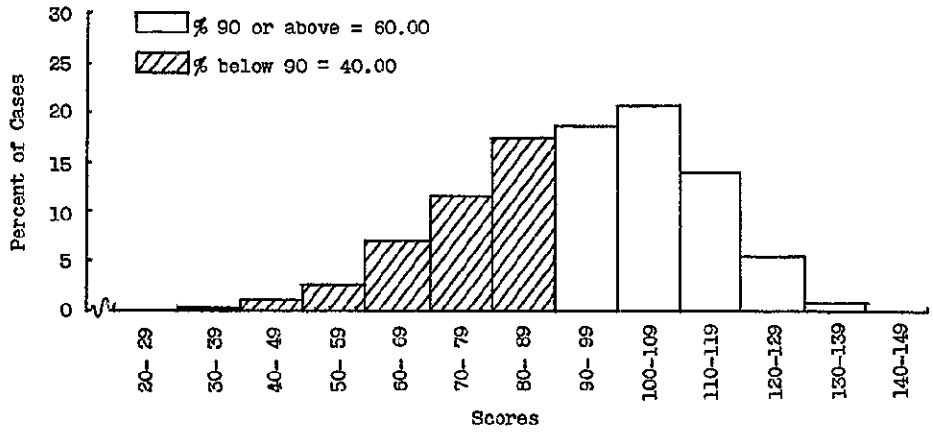


FIGURE 6

SCORES MADE ON TEST AC-10-A BY A REPRESENTATIVE
GROUP OF 1,000 APPLICANTS

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942), 19.

36. The test used in this case was Test AC-10-B, but the percentage passing on AC-10-A would have been quite similar since the former was equated with the latter.
37. "Report on the Aviation Cadet Qualifying Examination," 18-19.
38. Ibid.

[redacted]

[redacted]

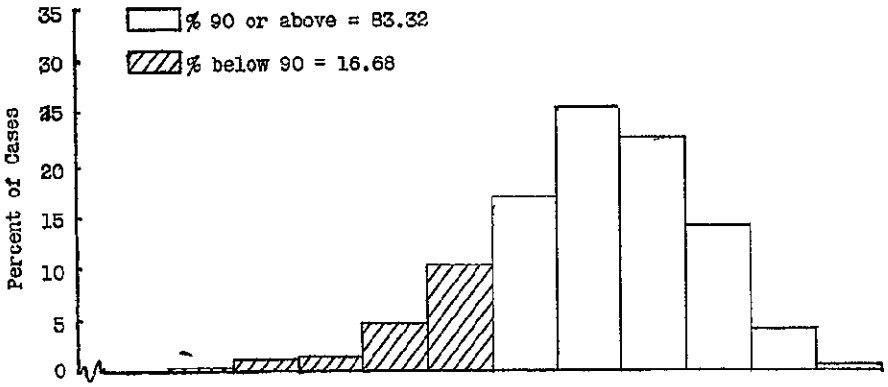


FIGURE 1

SCORES MADE ON TEST AC-10-A BY MEN ALREADY ENLISTED AS AVIATION CADETS FOR TRAINING AS PILOTS, BOMBARDIERS OR NAVIGATORS

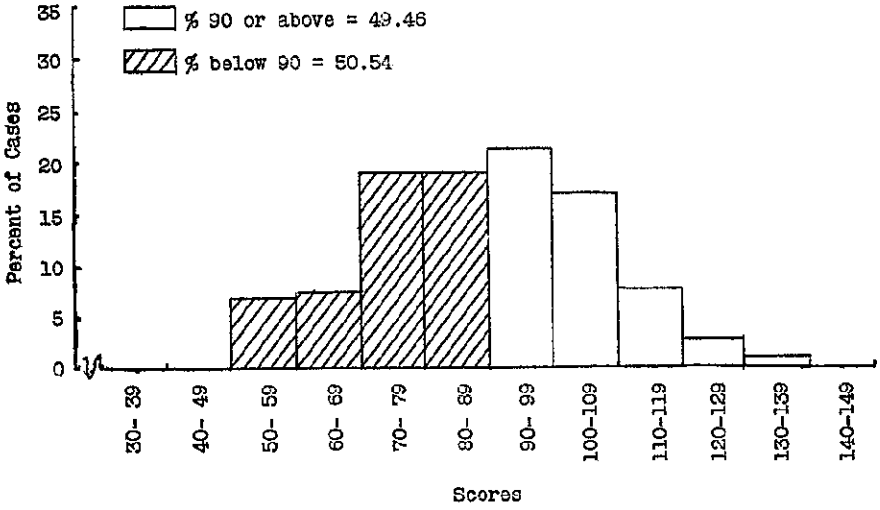


FIGURE 2

SCORES MADE ON TEST AC-10-A BY ENLISTED MEN ALREADY SELECTED FOR PILOT TRAINING

Source: "Report on the Aviation Cadet Qualifying Examination" (October 1942),15.

The standards established by the Qualifying Examination, therefore, were such as to prevent the acceptance for training of even college trained aviation cadets who were as low in aptitude as the lowest groups in former classes. On the other hand, applicants were admitted under the new requirements who had not attended college and who lacked some of the specialized information and the social graces that were acquired during attendance at a college or university. In aptitude for flying, however, they ranked as high or higher than applicants admitted prior to January 15, 1942.[33]

---

33. Ibid.

[redacted]

[redacted]

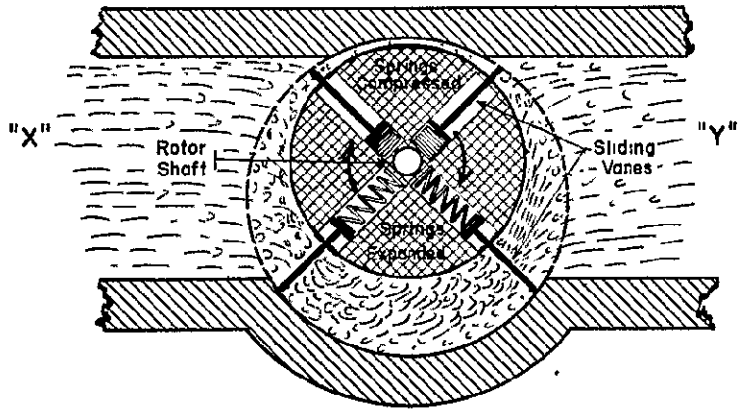


Fig. I

FUEL PUMP

The most common engine driven fuel pumps used in airplane fuel systems are of the eccentric sliding-vane type of pump shown in Figure 1. When the pump rotor is turned the vanes move the fuel from the inlet to the outlet of the pump. Since the pump is symmetrical about a vertical axis, it will pump in either direction with equal efficiency. Reversing the direction of rotation has the same effect as changing the pump on the mount 180°

136. As the pump in Figure 1 is rotated in a clockwise direction (as indicated by the arrows) it forces the fuel
- 136-A toward the opening at X.
- 136-B toward the opening at Y.
- 136-C toward opening X and Y in equal amounts.
- 136-D toward the center of the rotor shaft.
- 136-E around the axis of the pump in a continuous circuit.

137. If it is desired to increase the flow of fuel through this pump, the simplest procedure would be to
- 137-A shift the position of the vertical axis.
- 137-B change the pump on the mount by exactly 180°
- 137-C increase the size of the inlet and outlet openings.
- 137-D shorten the sliding vanes.
- 137-E increase the speed of rotation of the vanes.

138. If one of the sliding vanes were to be removed and the slot in the shaft plugged up, rotation of the shaft would then
- 138-A move the fuel about the same as before.
- 138-B pump no fuel at all.
- 138-C force out fuel in an irregular or pulsating stream.
- 138-D pump fuel in a direction the opposite of the former direction.
- 138-E pump first in one direction, then in another.[24]

---

24. Test AC-10-A, 13; "Report on Aviation Cadet Qualifying Examination," 12.

[redacted]

practical advantages and disadvantages of each procedure and select the most efficient solution from the five presented. The purpose of this section was to pick out individuals who were resourceful and who were able to "size up" a situation and exercise sound, independent judgment. It was designed to measure some of the requisite characteristics of men who were to be placed in positions of responsibility and leadership. An example from this section follows:

68. A solitary driver is on an urgent mission in a small scout car. In the car are an axe, a spade, a spare can of gasoline, and 10 feet of 1-inch rope. The driver comes to a big tree which has fallen down from a cliff and is lying directly across the road. The trunk of the tree is 4 feet in diameter and rests directly on the gravel roadbed. On one side is the cliff, on the other a river, so that the driver cannot drive around the fallen tree. In such circumstances his best procedure would be to
    68-A chop out a section of the tree trunk and roll it aside.
    68-B ditch the road alongside the tree and roll the trunk into this ditch.
    68-C burn out a section of the tree trunk, using the gasoline.
    68-D tie the rope to one end of the tree and with the scout car pull the tree aside.
    68-E take a detour which will take one hour.[21]

The mathematics section (Part IV) contained items covering simple mathematics. Each item consisted of a mathematics problem and five choices, only one of which was the correct answer. The questions covered such topics as: (1) facility in handling numbers, figures, and quantitative relations; (2) knowledge of the mechanics of computation; (3) accuracy of computation; and (4) simple mathematical reasoning. The nature of the questions was such that they could be answered by capable individuals with as little as two and one half years of high school mathematics. This section was of special significance for selecting navigation students. However, it was designed to measure many of the skills and quantitative abilities that are required of other aircrew members. The section also contained problems requiring the ability to use and interpret data contained in graphs, tables, and charts. Illustrative examples are shown below:

82. If a motor makes 2000 revolutions per minute, the number of revolutions it can make in 2/3 of an hour is
    82-A 3,000
    82-B 1,333 1/3.
    82-C 90,000
    82-D 50.
    82-E 80,000

96. Two planes leave the same port at the same time, both flying in the same direction. If one travels 150 miles an hour and the other 250 miles an hour, in how many hours should the planes be 400 miles apart?
    96-A 1.
    96-B 1 3/5.
    96-C 5.
    96-D 2 2/23.
    96-E 4.

99. Logarithms are the least useful in which one of the following processes?
    99-A Subtraction.
    99-B Cube root.
    99-C Division.
    99-D Square root.
    99-E Multiplication.[22]

The "alertness to recent developments" section (Part V) contained items measuring information about late developments in the world. Items from each of the following fields were chosen: (1) aviation, (2) science, and (3) military affairs. Only happenings or facts that were of general significance and that had been given wide publicity were used, so that all persons

21. Test AC-10-A, 6; "Report on Aviation Cadet Qualifying Examination," 11.
22. Test AC-10-A, 8; "Report on Aviation Cadet Qualifying Examination," 12.

[redacted]

ments, are considered a distinctive step forward."[13]

Following the recommendation of this board, Test AC-10-A was officially put into use on January 15, 1942. All educational restrictions were removed and attainment of a passing score on the Qualifying Examination was established as the sole mental requirement for appointment as an aviation cadet.[14] About two hundred Aviation Cadet Examining Boards throughout the country began to administer the test to applicants. Examinations were held daily, or as often as circumstances warranted. Those who had failed the written educational examination on November 12, 1941, were notified that they were eligible to qualify under the revised educational requirements.[15] Under this new plan candidates failing in one examination were required to wait thirty days before taking a re-examination.[16]

Test AC-10-A was used for approximately two and one half months, after which it was replaced by Test AC-10-B. Other improved forms have been released periodically.[17] While the Aviation Cadet Qualifying Examination was not a speed test, a time limit of three hours was established. This limit gave the average candidate ample time to complete the test.[18]

The fundamental purpose of the Aviation Cadet Qualifying Examination was to qualify for aviation cadet training those men who were sufficiently alert and intelligent to be capable of learning an aircrew assignment and who could measure up to the intellectual and leadership standards required of officers in the Army. The test was designed to measure aptitude rather than specific technical information, formal educational achievement, or specialized training.

Analysis of Test AC-10-A

Various types of items were included to insure that individuals passing the test would possess those qualifications required for success in aircrew assignment. Test AC-10-A consisted of six main parts--Part I, Vocabulary; Part II, Reading Comprehension; Part III, Practical Judgment; Part IV, Mathematics; Part V, Alertness to Recent Developments; and Part VI, Mechanical Comprehension.

Each item in the vocabulary section (Part I) consisted of an incomplete sentence followed by five possible endings, one of which completed the sentence most satisfactorily. This section was designed to select men of good general intelligence who would be able to comprehend directions. Vocabulary tests were designed to predict the candidate's ability to understand and remember the sort of material that was covered in aircrew ground schools, where the student would be expected to remember what he read and heard. Sample items from the vocabulary section are shown below:

20. Pyrotechnic signals make use of
    20-A cannon.
    20-B depth charges.
    20-C Fireworks.
    20-D smoke columns.
    20-E radio.

25. Two circles which overlap but do not have the same center are
    25-A elliptical.
    25-B eccentric
    25-C congruent.

---

13. Report of Special Board to Chief, AAF, Jan. 14, 1942, in AAG 211 E #2, Cadets.
14. Annual Report of the Psychological Division (1942), 3.
15. Assistant Chief, Aviation Cadet Section, MPD, to Commanding General, Fifth Corps Area, Jan. 15, 1942, in AAG 352.12, Examinations.
16. Assistant Chief, Aviation Cadet Section, MPD, to Librarian, Public Library, Cedar Rapids, Iowa, March 6, 1942, in ibid.
17. Annual Report of the Psychological Division (1942), 10.
18. AG to Commanding General, Second Corps Area, March 10, 1942, in files of Aviation Cadet Branch.

[redacted]

[redacted]

Chapter IV

THE AVIATION CADET QUALIFYING EXAMINATION, 1942-1943

A series of conferences had been held during November 1941 to speed the development and refinement of a test to measure the aptitude and proficiency of the applicants for flying training, rather than their knowledge of formal educational matter, had been held during November 1941.[1] At their conclusion, representatives of the Military Personnel Division, Training and Operations Division, and the Medical Division, all of the Office, Chief of the Air Corps, had recommended that responsibility for such a test be assigned to the Psychological Research Agency in the Medical Division. Official action on this recommendation had been taken by Brigadier General George E. Stratemeyer, then Assistant Chief of the Air Corps, who signed a directive on December 20, 1941, which established responsibility for aircrew selection and classification procedures.[3] An important reason for assigning responsibility in developing the qualifying examination to the Medical Division had been that a staff of individuals with professional training in the development and application of practical testing procedures had been built up in this office, and an extensive research program involving study of aircrew requirements and the development of aptitude tests for aircrew members had already been started.[4]

As early as June 14, 1941, the Chief of the Air Corps had approved a plan for the establishment of a Psychological Research Agency in the Medical Division, Office, Chief of Air Corps, to determine the characteristics necessary for success in pilot training schools, and to develop aptitude tests for measuring these characteristics.[5]

In order to facilitate this research, the Training Section of the Training and Operations Division had modified the program of instruction at Pilot Replacement Training Centers in the autumn of 1941 to include an allowance of six hours for psychological testing. The first Psychological Research Section had been established at Maxwell Field, Alabama, on September 22, and examination of the second class (42-E) to enter the Replacement Training Center was begun on October 11.[6] On December 13, 1941, the Medical Division had been made responsible for research on the selection and classification of bombardiers and navigators, in addition to research already in progress on pilots.[7]

In making plans for the original research program, it had been anticipated that a full year would be devoted to the accumulation of data, the tryout of preliminary tests, and analysis of results in relation to flying training records. The pressure of the emergency training program and American entry into the war made it necessary to proceed immediately with plans for the application of selection and classification tests which could sort out, from among hundreds of thousands of applicants, those possessing flying aptitudes, and then to divide this latter group into three sub-divisions containing those best fitted for pilot, navigator, and bombardier training. As early as April 10, 1941, a directive had been sent from the Chief of the

---

1. "Report on the Aviation Cadet Qualifying Examination," 8.
2. Annual Report of the Psychological Division, Office of the Air Surgeon (1942), 2.
3. Memo for Medical Division, Military Personnel Division, and Training Division, OCAC, by Assistant Chief of Air Corps, Dec. 20, 1941, in files of Aviation Cadet Branch.
4. "Report on the Aviation Cadet Qualifying Examination," 8; R&R, Aviation Cadet Section, MPD, to Medical Division, Aug. 20, 1941, in files of Aviation Cadet Branch; R&R, Medical Division to MPD, Aug. 30, 1941, in ibid.
5. Annual Report of the Psychological Division (1942), 1.
6. Ibid., 2.
7. "Report on the Aviation Cadet Qualifying Examination," 9.

[redacted]

overcome this difficulty, the Air Corps had requested the Personnel Procedures Section of The Adjutant General's office to construct a set of objective examinations for use in initial selection.[18] The first objective-type educational examination was given during November 1941. Candidates were examined in five required subjects--English composition, arithmetic, geometry, trigonometry, and algebra--and from a list of five additional subjects--general history, United States history, physics, chemistry, or a foreign language--they were permitted to select any two options.[19] Men who could show college completion of any of the subjects could claim exemption and be given an arbitrary grade of 80 in that subject.[20] While the objective examination proved more reliable and required much less time to score than the older essay tests, it was not suited to the wartime needs of the Air Corps. It had been constructed to measure the level of education and training of applicants rather than aptitude for flying.[21]

As the aviation cadet training program had expanded, a number of new problems had arisen. It became clear that specialized training for the different aircrew positions was needed. In the summer of 1940, therefore, specialized navigator and bombardier training had been introduced. The first bombardier and navigator classes were composed of men selected from among cadets who had been eliminated from pilot training. Some men were sent to Florida for navigation training under the supervision of the Pan-American Airways instructors. Others were sent to Lowry Field for training as bombardiers.[22] In the first two years after these specialized schools were opened, the number of bombardiers and navigators graduated was as large as the total number of pilots graduated during the preceding sixteen years.[23]

Numerous changes in selection and training procedure followed the introduction of specialized aircrew training. At first the selection of men for bombardier and navigator schools was the responsibility of the Faculty Boards that eliminated men from pilot training. These boards made an effort to select men for navigation training who were well grounded in engineering and mathematics. It was also general practice not to recommend for navigation training any cadet who had been eliminated from pilot training for failure in ground school.[24]

The selection of bombardier and navigator students from lists of eliminated pilots was criticized by certain officers in charge of these types of training. It was asserted that this practice tended to place the importance of the bombardier and navigator below that of the pilot in the aircrew. It was also believed to have an adverse effect on morale in bombardier and navigator schools.[25] As a result, the policy was changed, and in October 1941 enlistment for bombardier and navigator training was placed upon the basis of education and aptitude.

---

18. Memo for AG by Assistant Chief MPD, May 9, 1941, in ibid.; memo for AG by Assistant Chief, MPD, May 27, 1941, in ibid.; memo for Executive, OCAC by Chief, MPD, May 29, 1941, in files of Aviation Cadet Branch; memo for AG by Executive, MPD, June 9, 1941, and following dates, in AAG 352.12, Examinations.
19. The August 1941 educational examination introduced these changes, but it was not a completely objective-type examination. Educational Examination for Aviation Cadet Appointment, Aug. 12, 1941, in files of Aviation Cadet Branch; "Cadet Mental Tests Undergoing Revision," in Air Corps News Letter, XXIV (Aug. 1941), 7.
20. OCAC Memorandum /n.d., approximately June 25, 1941/, in files of Aviation Cadet Branch.
21. Memo for Chief of Air Corps by AG, Oct. 27, 1941, in AAG 352.12, Examinations; R&R, Aviation Cadet Section, MPD, to AC/AS, A-1, Nov. 28, 1941, in files of Aviation Cadet Branch; R&R, Chief of Air Staff to AC/AS, A-1, Nov. 15, 1941, in ibid.
22. "Report on the Aviation Cadet Qualifying Examination," 6; Executive, OCAC to AG, June 25, 1940, in AAG 211 E, Cadets; cf., memo for Chief of Staff by Chief of Air Corps, May 24, 1940, in AAG 353 C, Air Corps Training Directives and Program.
23. "Report on the Aviation Cadet Qualifying Examination," 6.
24. Assistant Chief of Air Corps to Commanding Generals, Training Centers, June 16, 1941, in AAG 353.9, Specialized Training.
25. Assistant Commanding Officer, Air Corps Technical School, Denver, Colo., to Chief of Air Corps, Oct. 3, 1940, in ibid., R&R, T&O to AC/AS, A-1, Aug. 26, 1941 and following dates, in ibid.

[redacted]

cent in the fiscal year 1941, to 28.5 per cent in 1942, and to approximately 25 per cent[6] in 1943.

TABLE VI

PHYSICAL EXAMINATIONS FOR FLYING, 1939 - 1943

	Qualified		Qualified with waiver	
	Civilian	Enlisted	Civilian	Enlisted
1939[1]	2,792	138	101	1
1940	-	-	-	-
1941[2]	21,623	3,954	467	35
1942[2]	138,254	47,507	-	-
1943[3]	316,051		-	-

	Disqualified				Total	
	Civilian	Per cent	Enlisted	Per cent	Civilian	Enlisted
1939[1]	7,902	73.2	165	54.2	10,795	304
1940	-	-	-	-	-	-
1941[2]	22,386	50.3	2,359	37.1	44,476	6,348
1942[2]	53,834	38.9	13,546	28.5	192,088	61,053
1943[3]	25.0%				316,051	

1. Calendar year
2. Fiscal year
3. Fiscal year; data incomplete; no breakdown as between civilian and enlisted shown; Statistical Division, Office of the Air Surgeon, estimates the number disqualified at 25 per cent on the basis of complete data received during the first six months.

Sources: Annual Report of the Surgeon General of the U. S. Army (1940, 1941); Annual Report of the Office of the Air Surgeon (1942, 1943).

While interpretation of the physical qualifications was being adapted to wartime needs, a similar adjustment was being made in respect to the educational requirements. In 1939 the examination was made somewhat less difficult; and in many sections of it objective-type questions were substituted for the old essay-type. Young men with less than two years of college training were encouraged to take the examination.[7] Boards of education, chapters of the American Legion, and other organizations in various parts of the country inaugurated courses for high school graduates to assist them in passing the mental examination required to qualify as flying cadets.[8]

A further impetus was given the flying cadet program when on July 2, 1940, Congressional legislation authorized the suspension during the fiscal year 1941 of all existing limitations on the number of flying cadets in the Air Corps.[9] The enactment into law of the Army Aviation Cadet Act on June 3, 1941, gave additional encouragement to aircrew procure-

6. Office of the Air Surgeon to Dr. Ludlow Stevens, Feb. 4, 1943, in AAG 741, Misc.; Annual Report of the Surgeon General (1940, 1941); Annual Report of the Office of the Air Surgeon (1942, 1943).
7. Questions for Educational Examinations for Appointment as Flying Cadets, Air Corps, 1921-1942, in files of Aviation Cadet Branch.
8. Memo for all District Recruiting Officers, etc., Second Corps Area by Second Corps Area Recruiting Officer, Oct. 14, 1940, in AAG 211 E, Cadets; memo for Chief, Personnel Division, OCAC, by Chief, Flying Cadet Section, Nov. 4, 1940, in files of Aviation Cadet Branch.
9. 54 Stat. 712.

[redacted]

This list was normally large and appointments were made according to a prescribed priority regardless of the date of examination. Candidates who had been on the eligible list for longer than six months were required to undergo another physical examination for flying before appointment could be authorized. When an applicant whose name was carried on the eligible list reached his twenty-seventh birthday, his name was automatically dropped from the list.[40]

The priority system in use for the selection of flying cadets in 1939 was as follows:

a. (1) Graduates of the United States Military Academy, the United States Naval Academy, and the United States Coast Guard Academy who apply for appointment as flying cadets within 1 year from date of graduation, who fail to receive commissions because of lack of vacancies and are recommended for appointment as flying cadets by the respective superintendents of those academies.
   (2) Enlisted men of the Air Corps of the Regular Army who at time of appointment have served at least 11 months.
b. Other enlisted men of the Regular Army who at time of appointment have served at least 11 months.
c. Officers and enlisted men of the National Guard who at time of appointment have been assigned to Air Corps units for at least 11 months and who are favorably recommended by their commanding officers.
d. College graduates who are graduates of Reserve Officers' Training Corps units of other arms or services.
e. Graduates of recognized colleges and universities.
f. Other officers and enlisted men of the National Guard who at time of appointment have had at least 11 months' service.
g. Reserve officers and members of the Enlisted Reserve Corps who at time of appointment have served at least 11 months.
h. Students in good standing of recognized universities, who have completed their sophomore year.
i. Others.[41]

Classes were usually filled with candidates from the first five groups.[42] The average education of flying cadets in 1939 was three years of college.[43]

The flying cadet program for the fiscal year 1939 called for three classes. The authorized number of cadets for the year was 549, which meant that about 200 entered each class. For the March 1939 class there were approximately 800 men on the eligible list. As a result, the great majority of those appointed flying cadets were college graduates, two-year college men, or men with a record of military service.[44] Flying cadets were regarded by both the public and the Army as a highly selected group of individuals who were to be given a rare opportunity, namely, a chance to learn flying at the West Point of the Air, Randolph Field, Texas.

---

40. Flying Cadets of the Army Air Corps (1939).
41. Ibid.; AR 615-160, July 20, 1938.
42. Memo for Qualified Flying Cadet Candidates by Chief, Personnel Division, OCAC, May 20, 1930, in files of Aviation Cadet Branch.
43. Records of Aviation Cadet Branch.
44. Ibid.

rated in the summer of 1943 as part of a larger study, but results will not be available before the summer of 1944.[34]

Despite criticism of the ARMA as unscientific, many medical men regard it as an essential part of the flying examination since it measures qualifies which neither the psychological nor the routine physical examination has covered.[35]

Table V presents a detailed analysis of the disqualifying physical defects of applicants for flying cadet training during the calendar year 1939.[36] The same general pattern is to be observed in succeeding years.[37] In 1939 a total of 15,104 physical defects were found on 8,067 applicants for flying cadet training who were disqualified.[38] Many of these applicants had two or more physical defects which were disqualifying. On the eyes alone 5,264 disqualifying conditions were noted, 1,842 of these being instances of substandard visual acuity. The next largest number of defects, 3,327, was found to be under the cardiovascular system, 129 being due to heart conditions, 1,516 to blood pressure, and the remaining 1,682 to neurocirculatory instability (Schneider Index). Unsatisfactory ratings on the flying adaptability test (ARMA) resulted in the rejection of 911 applicants.[39]

34. Memo for Recruiting and Induction Section, AGO by AAG, June 21, 1943, in files of Research Division, Office of the Air Surgeon.
35. J. H. Schroeder, "A Study of the Proposed Flying Adaptability Test (A.C.) in the Course of Physical Examination of Civilian Aviators," in Journal of Aviation Medicine, III (1932), 150-55; J. M. Murray, "Psychiatry in the Army Air Forces," in American Journal of Psychiatry, C (1943), 21-24; W. S. Jensen, Aviation Medicine (a lecture delivered at the Jewish Hospital, Philadelphia, Penna., April 29, 1943).
36. Annual Report of the Surgeon General (1940), 268.
37. Annual Report of the Surgeon General (1941), 257-59; Annual Report of the Office of the Air Surgeon (1942); ibid. (1943).
38. Data regarding the total number of applicants examined, the number qualified, those qualified with waiver, and the number disqualified are given in Table VI.
39. Annual Report of the Surgeon General (1940), 268-69.

color vision test. For the administration of the color vision test the medical examiner made use of the Ishihara or American Optical Company books of pseudo-isochromatic plates. A candidate with normal color perception and mental alertness could easily read the plates. If he missed more than 25 per cent of them, he was considered unsafe for aircrew training and was disqualified. If he missed 25 per cent or less of the plates, he was given an adjunct test with the SAM (School of Aviation Medicine) lantern or with the Holmgren yarns.[27]

Another important test was the Schneider Index. This index was a numerical score derived from changes in the pulse rate and blood pressure caused by changes in posture and by exercise. The individual showing signs of vasomotor instability and poor adaptability for military aeronautics often obtained a repeatedly low score on the index. While a candidate was never disqualified on the index alone, an index persistently less than eight meant a poor pulse response to exercise and posture, and the medical examiner then attempted to determine the cause. The blood pressure of every candidate was carefully checked, and if it was found to be abnormal, or in case of doubt, the procedure was repeated for a sufficient number of days to enable the examiner to arrive at a definite conclusion. Blood pressure requirements for aircrew training were. systolic, 100 minimum, 134 maximum; diastolic, 89 maximum. An X-ray of the chest was used to test for tuberculosis. Still other tests were used where circumstances indicated their desirability. Since the physical examination for flying was reported on W.D., A.G.O. Form No. 64, it was frequently referred to as the "64" examination.[28]

The most difficult part of the entire examination, perhaps, was the detection of mental and nervous diseases. For this purpose the candidate was subjected to a psychiatric examination, upon the basis of which he was given a flying adaptability rating. From the flight surgeon's point of view, the Adaptability Rating for Military Aeronautics, or ARMA as it was called, gave him an opportunity: (1) to study the applicant's psychophysical organization in order to determine whether it was normal, and if not, to decide whether the deviation was sufficiently great to make flying unsafe, either temporarily or permanently; aspects especially considered were intelligence, emotions, psychomotor activity, somatic demands, and the condition of the nervous system; (2) to determine the applicant's manner of reacting to his environment, whether adequate or not, and whether it was likely to make for efficiency or inefficiency in flying; (3) to determine in so far as possible personality trends, potentialities, limitations, and the existence of any latent tendencies which under stress of flying might become manifest and make for inefficiency; (4) and finally, to classify the individual as either qualified or disqualified.[29]

The test was conducted in the form of an interview, during which the flight surgeon by means of skillful questioning of the candidate was able to obtain the desired information. The candidate was examined and scored on the following basis:

		Value	Score
1.	Family history--biologic inheritance and setting; father; mother; siblings; adjustment difficulties; reaction of family toward flying.	5	-
2.	Environment--rearing; location; age position; economic conditions; discipline; interest; principles; reaction; worth.	5	-
3.	Morphology--physical factors in shaping personality development; birth traumas; stammering; illness, injury.	10	-
4	Intelligence--importance; educational career; adjustments; work life; learning; memory; imagination; attention; perception; comprehension; judgment; tact.	60	-

27. AR 40-110, Feb. 21, 1939; School of Aviation Medicine, Flight Surgeon's Handbook (2nd ed., April 30, 1943), 30-42.
28. Flight Surgeon's Handbook, 9-10, 17-18; AR 40-110, Feb. 21, 1939; WD, AGO Form No. 64 (Physical Examination for Flying).
29. TM 8-320, 266; AR 40-110, Feb. 21, 1939.

by The Adjutant General, were located at practically all Regular Army Air Corps stations where there were flight surgeons and the special medical equipment required for the physical examination. The boards consisted of three experienced officers of the Regular Army, including at least one Air Corps officer and as many others as practicable, and one medical officer, the flight surgeon. In 1939 there were thirty-seven such boards scattered throughout the country.[20]

Unless the applicant had presented documentary evidence of having fulfilled the educational requirements, he was required to take an examination. Written essay-type educational examinations were scheduled for the second Tuesday in August, November, February, and May.[21]

The Physical Examination, 1939

While only a small percentage of flying cadet applicants met the educational qualifications by taking a written examination, all applicants were required to take the physical examination which was given by the flying cadet examining boards at such times as were practicable. This examination was designed to select physically normal applicants and eliminate those with defects or disease which might become aggravated by flying training or which might increase the hazard of such training.

The physical standard for flying, which was prescribed by AR 40-110, was higher than that for enlistment in the Regular Army, and the examination itself was somewhat different, particular attention being given to those factors and functions of greatest importance in flying.[22] The routine examination included a thorough general inspection of the entire body, noting the proportions and symmetry of the various parts of the body, the chest development, the condition and tone of the muscles, the general nutrition, the character of the skin, and the presence of any deformities or of signs of immaturity.[23] Candidates were required to meet prescribed standards of height, weight, and chest measurements as shown in Table IV.[24]

The mouth, nose, fauces, pharynx, larynx, trachea, oesophagus, neck, spine, abdomen, pelvis, and the genito-urinary system were examined by inspection and palpitation. The minimum dental requirement consisted of a total of six masticating teeth and of six incisor teeth, all of which were so opposed as to serve the purpose of incision and mastication. In general, physical defects which would disqualify for enlistment in the Regular Army also disqualified for flying training.[25]

In addition to the routine physical examination, candidates for appointment as flying cadets in 1939 had to meet the following physical and mental requirements: vision 20/20 bilateral without glasses; unimpaired ocular muscle balance; and unimpaired optical organism, anatomically and mechanically; good respiratory ventilation and vital capacity; hearing 20/20 bilateral; a stable equilibrium; a sound cardio-vascular system, nervous and organic; a well-formed, well-adjusted, and coordinated physique; and an integrated and stable central nervous system combined with a temperamental constitution suitable for military flying.[26]

---

20. Ibid.; AR 615-160, July 20, 1938.
21. AR 615-160, July 20, 1938; Flying Cadets of the Army Air Corps (1939).
22. AR 40-110, Feb. 21, 1939; AR 40-105, May 29, 1923; AR 40-105, c 4, Feb. 12, 1936.
23. AR 40-105, May 29, 1923; AR 40-105, c. 4, Feb. 12, 1936.
24. AR 40-105, c.3, Nov. 15, 1932; AR 40-110, Feb. 21, 1939.
25. AR 40-105, May 29, 1923; AR 40-105, c. 4, Feb. 12, 1936.
26. AR 40-110, Feb. 21, 1939; Flying Cadets of the Army Air Corps (1939)

[redacted]

While minor changes were made from time to time in the subjects covered and in the type of special examinations given, the two-year college requirement remained in effect from 1927 until January 1942 in spite of numerous attempts to lower it.[12]

Table III shows the results of the special educational examinations that were given in the fiscal years 1923 to 1941, inclusive, and in the first half of the fiscal year 1942. It will be noted that in the years preceding 1940 an average of 35 per cent of the men who took the tests obtained passing marks. The group who qualified for training by passing the special educational examinations, however, constituted only about 6 per cent of the total number assigned to training.[13]

TABLE III

RESULTS OF THE SPECIAL EDUCATIONAL EXAMINATION FOR AVIATION CADETS

Fiscal Years 1923 to 1942

Fiscal Year	Number of Applicants	Number of Examinations Held	Number Passing Examinations	Per cent Passing
1923	17	1	5	29.4
1924	92	3	28	30.4
1925	105	2	15	14.3
1926	149	3	41	27.5
1927	116	1	25	21.6
1928*	363	3	5	1.4*
1929	246	3	24	9.8
1930	176	2	48	27.3
1931	119	2	14	11.8
1932	75	3	25	33.3
1933	57	3	24	42.1
1934	47	3	8	17.2
1935	35	3	11	31.4
1936	53	3	20	37.7
1937	83	3	12	14.5
1938	237	3	68	28.7
1939	332	3	157	47.3
1940	928	4	355	38.3
1941	9,272	4	2,478	26.7
First half of 1942	8,992	2	5,562	61.9

* Educational requirements changed from 4 years of high school to 2 years of college.

These data were compiled from the records of the Aviation Cadet Section, Office of the Director of Personnel, Hq., AAF. ("The Aviation Cadet Qualifying Examination--A Report of the Purpose, Development and Validation of Test AC-10-A," October 1942, p. 5.)

12. On January 15, 1942, the educational examination was supplanted by the Aviation Cadet Qualifying Examination. Ibid.; memo for Robert A. Lovett, Special Assistant to the Under Secretary of War, by General George H. Brett, April 4, 1941, in AAG 351.28, Applicants; cf., memo for General Henry H. Arnold by Chief, Personnel Division, OCAC, March 24, 1937, in files of Aviation Cadet Branch; Proceedings of Board of Officers, OCAC, Jan. 20, 1938, in ibid.
13. Records of Aviation Cadet Branch.

[redacted]

[redacted]

the high school subjects, were commonly used for this purpose.[7] By 1925 two scheduled examinations were held each year for the purpose of qualifying applicants who could not submit evidence of graduation from high school or attendance at college within the one-year period preceding the date of examination.[8]

As a result of the popular impetus given aviation by the early transoceanic flights and other favorable publicity, it was possible to raise the educational requirements in 1927 so that only those men with two years of college training or its equivalent were qualified.[9] Applicants who had not completed two years of college could still qualify, however, by passing a special examination on nine college subjects--English grammar and composition, United States history, general history, geography, arithmetic, higher algebra, geometry, trigonometry, and elementary physics. Each subject was graded upon a basis of 100 per cent, and the final grade was the average grade received in the combined subjects. The passing grade was 70. The first special examination of this nature was held in August 1927.[10]

Excerpts from this examination are given below:

English Grammar

1. Classify in parallel columns the following pronouns as personal, demonstrative, relative, and indefinite: this, each, who, that, what, any, she, all, we, himself, whatever, those, their, who, it.

2. Write five sentences containing the following (underline each required phrase or clause):
   (a) an adjective clause
   (b) a noun clause
   (c) an adverb clause
   (d) a noun phrase
   (e) a verb phrase

7. Parse the underlined words in the following sentence:

   That man is truly happy who has solved the question of how he begins, and not of how he ends, of what he wants and not of what he has.

English Composition and English Literature

1. Write a theme of about 500 words on a subject chosen by yourself.

3. Make a list of the principal American authors of the nineteenth century and state in what field each excelled (whether as poet, dramatist, historian, etc.). Give at least 12 names.

4. Make a list of the principal English authors of the nineteenth century and name one work of each.

---

7. AR 615-160, Oct. 12, 1921; Office of the Director of Air Service, Special Regulations No. 111, "Appointment of Flying Cadets to Air Service Schools" (1920).
8. Records of Aviation Cadet Branch.
9. AR 615-160, Dec. 31, 1927; memo for General Mason M. Patrick by Assistant Secretary of War, Nov. 24, 1926, in files of Aviation Cadet Branch; memo for Chief, Personnel Division, OCAC, by Enlisted Section, Personnel Division, Dec. 7, 1926, in ibid.; memo for flying cadet candidates by Acting Chief, Personnel Division, OCAC, July 7, 1927, in ibid.
10. Questions for Educational Examinations for Appointment as Flying Cadets, Air Corps, Aug. 9, 1927, in files of Aviation Cadet Branch.

[redacted]

[redacted]

Chapter II

DEVELOPMENTS, 1919-1942

With the termination of the war, appropriations for military purposes were drastically reduced and the nation's aviation program languished. On July 11, 1919, an act of Congress was approved establishing the grade of flying cadet for student pilots in the Air Service and providing that the total number of flying cadets should not at any time exceed 1,300.[1] The maximum was raised by Congressional action on June 4, 1920, to 2,500 flying cadets,[2] but appropriations were so limited that at no time down to the inauguration of the expansion program in 1939 did the Air Corps have as many as 700 cadets entering flying schools in any one year.[3]

Throughout the twenty-year period 1919-1938, the supply of men interested in aviation far exceeded the demand. Standards for the initial selection of pilots[4] were set at a high level and the training was rigorous. Only a small number of men were able to complete successfully the full year of flying training. In 1923 authority was given for the examination of 631 men who were applying for pilot training. Of this number, only 127 men, or 20 per cent, met the rigid entrance requirements. In the same year only forty-five of those who had entered in previous classes were graduated from the advanced course at Kelly Field.

In Table II is shown the number of applicants, 1923 to 1939 inclusive, who were authorized to appear for examination during each fiscal year; and the number of men who qualified, who entered school, and who graduated from the advanced course during each of those years.[5] From the beginning of 1923 to the end of 1938 about 37,000 applicants for aviation cadet training were given permission to appear for examination. Of this number approximately 8,000, or 22 per cent, were found to be qualified for pilot training. Of the 8,000 men who were accepted, a number failed to report for training, and less than half of those who did start preliminary training during this sixteen-year period were successful in completing both the primary and advanced flying course. The largest number of cadets graduated from Air Corps schools during any one year was 246 (1932). Of the 37,000 applicants who had been examined originally, only 10 per cent were graduated.[6] This group of highly selected and highly trained pilots provided a pitifully small nucleus from which to build the great air armada soon to be demanded by war needs.

---

1. 41 Stat. 109.
2. 41 Stat. 759.
3. Annual Report Data, 1925-1940, in Records of Aviation Cadet Branch, Military Personnel Division, AC/AS, Personnel (hereinafter cited as Records of Aviation Cadet Branch); Psychological Division, Office of the Air Surgeon, "The Aviation Cadet Qualifying Examination --A Report on the Purpose, Development and Validation of Test AC-10-A" (Oct. 1942), 2 (hereinafter cited as "Report on Aviation Cadet Qualifying Examination").
4. The only course offered flying cadets prior to July 1940 was that in pilot training.
5. "Report on Aviation Cadet Qualifying Examination," Table I, 2.
6. Ibid.

[redacted]

4. Finger movement; first and second fingers moving together as rapidly as possible through an uncontrolled distance.
5. Swaying; standing with a helmet beneath smoked paper.
6. Visual acuity; Ives gratings.
7. Memory Test (Dodge's); words exposed one letter at a time.
8. Inhibition of winking reflex.
9. Eye reactions to light; moving from fixation point to a spot of light which appears.
10. Speed of eye movements.
11. Ocular pursuit movements; following pendulum.
12. Reversed maze; tracing it visibly and then invisibly and rotated.
13. Association reaction with crucial words involving fear, falling, etc.
14. Motor learning; learning a fixed series of reactions with two alternatives by trial and error.
15. Auditory difference threshold with loud standard similar to the sound of a motor.
16. Distance and velocity estimation; moving target passes across opening at constant rate and then disappears; the subject tries to stop it when it has reached (invisibly) a given point.
17. Continuous choice reaction; each stimulus being produced by the preceding correct reaction.
18. Tapping with index finger vertically between two fixed contacts.
19. Equilibrium reaction time; subject sitting on platform which tilts suddenly; choice reaction to the direction of tilt.
20. Simple visual reaction time.
21. Simple auditory reaction time.
22. Fatigue; ergograph with middle finger.
23. Emotional stability; changes in pulse, breathing and arithmetical performance as affected by a revolver shot.[3]

About seventy-five cadets were given the above series of tests. Arrangements had been made to correlate test performances with records from the flying schools as soon as these men learned to fly solo, and also when they received the rank of Reserve Military Aviator. Unfortunately, developments in Europe interfered with the carrying out of this program. The exigencies of war made it necessary to send some of the men directly from the ground school to overseas duty and, as a result, records of flying ability were obtained for only twenty-five of the men tested.[4]

During the autumn of 1917, the Committee on Psychological Problems of Aviation was reorganized. Harold E. Burtt, who had acted as chairman of the original committee, resigned, and George M. Stratton, who had been working independently on tests for aviators at Rockwell Field, San Diego, was appointed chairman. Edward L. Thorndike was chosen as executive secretary. W. R. Miles and L. T. Troland of the original committee continued their membership, while John B. Watson, Warner Brown, Francis Maxfield, and H. C. McComas were added.

A series of tests, properly weighted, had early appeared to be the most practical means of predicting aptitude for flying. Provision was made by the Army for a systematic and detailed tryout of promising tests at Rockwell and Kelly Fields in cooperation with the Committee on Classification of Personnel, which had been set up under the jurisdiction of The Adjutant General of the Army. The personnel of the group to whom the tests were given included one hundred men chosen on the basis of their special skill in flying, one hundred chosen as relatively inept at flying, and one hundred candidates of unknown ability. The work, carried on in the spring of 1918, resulted in provision by the War Department for further research and the authorization of four special examining units to apply the tests to candidates for cadetship.[5]

---

3. Robert M. Yerkes, "Report of the Psychology Committee of the National Research Council," in Psychological Review, XXVI (1919), 94-99; cf., "Psychological Problems of Aviation in World War I," in Aviation Psychology Abstract Series [prepared by Psychological Section, Research Division, Office of the Air Surgeon], Abstract No. 54, Nov. 4, 1942.
4. Aviation Psychology Abstract No. 54.
5. Ibid.

TEST 4

Write the correct answers to these problems. Use the margins of the pages to figure on.

3. A recruit spent one-eighth of his spare change for post cards and four times as much for a box of letter paper, and then had 90 cents left. How much money did he have at first? . . . . . Answer ( )
7. A U-boat makes 8 miles an hour under water and 15 miles on the surface. How long will it take to cross a 100-mile channel, if it has to go two-fifths of the way under water? . . . . . Answer ( )
10. A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the rest of its stock to 29 mess halls. Each mess hall received 54 barrels. What was the total number of barrels supplied? . . . . . .Answer ( )

TEST 5

In each of the sentences below, you have a choice among four words. Draw a line under the one of these four words which makes the truest sentence.

4. The howitzer is a type of machine-gun rifle cannon pistol.
5. The Zeppelin is a monoplane biplane dirigible submarine.
7. From Berlin to Petrograd is about 500 mi. 900 mi. 1,400 mi. 1,900 mi.[9]

From a study of the records of over two thousand fliers, Thorndike also determined the relationship between actual success as a military aviator and such factors as age, social status, intellectual ability, business achievement, and athletic ability. On the basis of his own research and that of others, he prepared a testing and rating plan as part of a general plan for the selection and classification of officer material in the Students' Army Training Corps, and it was adopted by the procurement branch of the Personnel Section of the Air Service. The plan was to have been put into operation in November 1918 for the selection of over one thousand aviation cadets per month from the Students' Training Corps, had not the war come to a close.[10]

Paralleling the work of the psychologists in developing written and psychomotor tests for measuring flying aptitude was that of the medical men in setting up physical and neuropsychic qualifications for flying cadets. Shortly after the entry of the United States into the war sixty-seven trained examining units were put into operation in the larger cities.[11] The original physical examination for flying lacked proper balance. The form which was used in recording the results of the examination, W.D., A.G.O. Form No. 609, was three pages in length, and over half of the space was devoted to the eye and ear. The nervous system, on the other hand, was allotted but one line. The instructions which accompanied the examination form were devoted exclusively to the eye and ear except for the final paragraph.[12] Physical standards required for qualification as flying cadets were high. The principal requirements were as follows: visual acuity of 20/20 vision in each eye; hearing acuity of 20/20 for the whispered voice; minimum height of 60 inches with no maximum limit; and minimum weight 110 pounds and maximum 190 pounds. The remainder of the general physical examination was routine. The nervous system was believed to have been

---

9. Ibid., 615-17.
10. Ibid., 604-14, 617-31; Aviation Psychology Abstract No. 54.
11. TM 8-320, 219.
12. Armstrong, Principles and Practice of Aviation Medicine, 30-31.

[redacted]

MEMORANDUM FOR THE COMMANDING GENERAL, ARMY AIR FORCES: (Office of the Assistant Chief of Air Staff, Intelligence; Attention: Chief, Historical Division)

Subject: Critique of "Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training"

[redacted]

C4-5426,AF

[redacted]

MEMORANDUM FOR THE COMMANDING GENERAL, ARMY AIR FORCES: (Office of the Assistant Chief of Air Staff, Intelligence; Attention: Chief, Historical Division)

Subject: Critique of "Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training"

[redacted]

C4-5426,AF

[redacted]

MEMORANDUM FOR THE COMMANDING GENERAL, ARMY AIR FORCES: (Office of the Assistant Chief of Air Staff, Intelligence; Attention: Chief, Historical Division)

Subject: Critique of "Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training"

[redacted]

C4-5426,AF

[redacted]

MEMORANDUM FOR THE COMMANDING GENERAL, ARMY AIR FORCES: (Office of the Assistant Chief of Air Staff, Intelligence; Attention: Chief, Historical Division)

Subject: Critique of "Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training"

UNCLASSIFIED

[redacted]

C4-5426,AF

[redacted] UNCLASSIFIED

MEMORANDUM FOR THE COMMANDING GENERAL, ARMY AIR FORCES: (Office of the Assistant Chief of Air Staff, Intelligence; Attention: Chief, Historical Division)

Subject: Critique of "Initial Selection of Candidates For Pilot, Bombardier, and Navigator Training"

[redacted]

C4-5426,AF